

1. The method of improving the performance of a cylinder/piston combination in an internal combustion engine using a fuel/air mixture, and subject to varying torque demands comprising the steps of:
 - (a) directing a fuel/air mixture into an associated volume outside but in communication with the cylinder;
 - (b) initiating combustion of the fuel/air mixture in the associated volume;
 - (c) completing combustion of the fuel/air mixture in the cylinder, and
 - (d) changing the size of the associated volume to vary the compression ratio of the cylinder/piston combination.
2. A method as set forth in claim 1 above, further including the step of providing fuel and air in at ratio of fuel to air that is at least stoichiometric or richer in fuel to the associated chamber.
3. A method as set forth in claim 1 above, further including the step of changing the compression ratio and fuel supply in accordance with the torque demand placed on the cylinder/piston combination.
4. A method as set forth in claim 1 above, wherein the steps of changing the size of the associated volume comprises varying the volume between a minimum and a desired value for each combustion sequence.
5. A method as set forth in claim 1 above, wherein the steps of changing the size of the associated volume comprises varying the volume between a minimum and a desired value for each combustion sequence during that portion of the engine cycle when the engine is at minimum pressure.
6. A method as set forth in Claim 1 above wherein the internal combustion engine is

a two-stroke cycle engine subject to a variable torque demand wherein the step of directing a fuel-air mixture comprises providing fuel in at least a stoichiometric ratio to the air, wherein the step of varying the compression ratio and fuel supply rate in accordance with the torque demand placed on the cylinder/piston combustion, wherein the associated volume comprises varying the volume between a minimum and the desired value for each combustion sequence of the two-stroke engine cycle during that portion of the engine cycle when the engine is at minimum pressure and wherein the method further comprises the steps of supplying air to the fuel-air mixture from the engine-driven blower.

7. The method of improving the performance of a cylinder/piston combination in an internal combustion engine using a fuel/air mixture, and subject to varying torque demands comprising the steps of:

- (a) directing all of the air supplied to said engine into both the main cylinder volume and into an associated volume outside but in communication with said cylinder volume;
- (b) directing all of the fuel into said associated volume forming therein a fuel air mixture;
- (c) initiating combustion of said fuel/air mixture in said associated volume;
- (d) completing combustion of said fuel/air mixture in said cylinder volume, and
- (e) changing the size of said associated volume to vary the compression ratio of said cylinder/piston combination.

8. A method as set forth in claim 7 above, further including the step of providing fuel and air in at ratio of fuel to air that is at least stoichiometric or richer in fuel to the associated chamber.

9. A method as set forth in claim 7 above, further including the step of changing the compression ratio and fuel supply in accordance with the torque demand placed on the cylinder/piston combination.

10. A method as set forth in claim 7 above, wherein the steps of changing the size of the associated volume comprises varying the volume between a minimum and a desired value for each combustion sequence.
11. A method as set forth in claim 7 above, wherein the steps of changing the size of the associated volume comprises varying the volume between a minimum and a desired value for each combustion sequence during that portion of the engine cycle when the engine is at minimum pressure.
12. A method as set forth in Claim 7 above wherein the internal combustion engine is a two-stroke cycle engine subject to a variable torque demand wherein the step of directing a fuel-air mixture comprises providing fuel in at least a stoichiometric ratio to the air, wherein the step of varying the compression ratio and fuel supply rate in accordance with the torque demand placed on the cylinder/piston combustion, wherein the associated volume comprises varying the volume between a minimum and the desired value for each combustion sequence of the two-stroke engine cycle during that portion of the engine cycle when the engine is at minimum pressure and wherein the method further comprises the steps of supplying air to the fuel-air mixture from the engine-driven blower.
13. The method of improving the efficiency of supplying air to a two-stroke internal combustion engine comprising the steps of
 - (a) supplying substantially the needed air from an engine driven blower for all torque values less than a certain percentage of full torque and
 - (b) supplying air from a blower driven by thermal energy in the exhaust of said engine for substantially all the air required by said engine at torque values above said certain value.
14. The method of improving the efficiency of a piston/cylinder combination in an internal combustion engine, comprising the steps of:

- (a) initially partially burning a combustible mixture of fuel and air in a precombustion volume;
- (b) conducting the combustion products and unburned fuel into the cylinder for completion of burning, while continuing the engine cycle, and
- (c) varying the precombustion volume in accordance with fuel supply rate to provide desired torque.

15. The method of throttling the output of a 2-stroke cycle internal combustion engine comprising the steps of:

- (a) initially partially burning a combustible mixture of substantially all the fuel and air in a precombustion volume;
- (b) conducting the combustion products and unburned fuel into the cylinder for completion of burning, while continuing the engine cycle, and
- (c) varying the precombustion volume in accordance with fuel supply rate to provide desired torque.

16. An internal combustion engine comprising:

- (a) at least one piston/cylinder combination having a main cylinder;
- (b) an auxiliary cylinder in communication with said main cylinder, said auxiliary cylinder being controllably variable in volume with an auxiliary piston to vary the compression ratio;
- (c) a fuel injection system for supplying fuel into communication with both cylinders,
- (d) a first control device controlling said fuel supply;
- (e) a second control device responsive to said first control device for varying said auxiliary volume in relation to the amount of fuel supplied.

17. An internal combustion engine as described in claim 16 above wherein said second control device coupled to said auxiliary cylinder controls compression ratio in inverse manner to the amount of fuel supplied by said first control device regulating fuel supply.

18. An internal combustion engine as described in claim 16 above wherein said second control coupled to said auxiliary cylinder controls compression ratio to change compression ratio with change in speed of said engine.
19. An internal combustion engine as described in claim 16 above wherein said second control coupled to said auxiliary cylinder operates substantially only during that time when pressure within said engine is close to the minimum value encountered during the engine cycle.
20. An internal combustion engine comprising:
- (a) at least one piston/cylinder combination having a main cylinder;
 - (b) an auxiliary cylinder with a piston in communication with said main cylinder, said auxiliary cylinder being controllably variable in volume to vary the compression ratio;
 - (c) a gas passage coupled to each cylinder,
 - (d) a fuel injection system for supplying fuel into said gas passage,
 - (e) a first control device controlling said fuel injection system, and
 - (f) a second control device responsive to said first control device for varying said secondary interior combustion volume in relation to the amount of fuel supplied.
21. An internal combustion engine as described in claim 20 above wherein said fuel injection system is designed to inject fuel in timed relation to operation substantially only during those periods of time when air is flowing from said main cylinder to said auxiliary cylinder.
22. A combustion chamber for a piston-driven internal combustion engine comprising:
- (a) a main chamber for receiving a piston, said main chamber having a principal interior combustion volume;
 - (b) a secondary chamber adjacent to said main chamber having a secondary

interior combustion volume;

- (c) a gas passage interconnecting said principal and secondary combustion volumes;
- (d) a controllable fuel supply coupled to provide fuel into a part of the interior volume defined by said chambers and said interconnecting gas passage;
- (e) a fuel igniter in operative relation to the combustible mixture;
- (f) a controllable movable element in said secondary chamber for varying the interior volume thereof;
- (g) a first control device controlling said fuel supply; and
- (h) a second control device responsive to said first control device for varying said secondary interior combustion volume in relation to the amount of fuel in said supplied combustible mixture.

23. A combustion chamber as set forth in claim 20 above, wherein the maximum volume in said secondary combustion volume is varied to change the compression ratio in response to torque demand.

24. An internal combustion engine comprising a volumetric combustion chamber, including:

- (a) a main cylinder incorporating a cyclically movable power piston therein having a main combustion volume
- (b) a secondary cylinder adjacent the main cylinder, the secondary cylinder defining a precombustion volume and incorporating a movable control piston for varying said precombustion volume in relation to the power piston;
- (c) a conduit connecting said main combustion volume with said precombustion volume,
- (d) a fuel system feeding fuel into said conduit;
- (e) an igniter in operational association with the combustible mixture for initiating combustion in said conduit in timed relation to the cycling of the power piston; and

- (f) a control coupled to the control piston for changing the range of movement thereof to vary the compression ratio of said combustion chamber in accordance with engine operation.
25. An engine as set forth in claim 24 above, where the control piston range is varied in accordance with engine speed.
26. An engine as set forth in claim 24 above, where the range is varied in accordance with torque demand.
27. An engine as set forth in claim 24 above, where the fuel feed rate is reduced with increased compression ratio.
28. An internal combustion engine piston cylinder combination having improved efficiency and lowered pollutant emissions, comprising:
- (a) a main cylinder/piston combination having a main combustion volume for expanding fuel/air mixtures from combustion during cyclic movement of said piston along a main axis; said main cylinder/piston combination including air intake and exhaust ports and valve mechanisms in operative relation to said main combustion chamber;
 - (b) an auxiliary cylinder/auxiliary piston combination having a precombustion chamber facing said main combustion volume and limited by the piston end wall, said auxiliary piston being movable within said auxiliary cylinder and mechanically biased toward said main cylinder/piston combination;
 - (c) a gas passage conduit coupled between said main combustion volume and said precombustion volume,
 - (d) a fuel injector feeding into said gas passage conduit in timed relation to the cycling of said main piston; and
 - (e) a controllable motion limiter in the path of said auxiliary piston on the side

opposite said precombustion chamber for variably changing the maximum volume of said precombustion chamber and the compression ratio of said main cylinder.

29. A hydraulic snubbing device to direct and limit cyclic movement of a control piston in an internal combustion engine comprising:

- (a) an auxiliary piston attached to said control piston constrained to move in simultaneous motion with said control piston,
- (b) an auxiliary control cylinder closely fitted around said auxiliary piston, said control cylinder filled with a substantially incompressible fluid,
- (c) a vent allowing flow of said fluid in and out of said cylinder,
- (d) an auxiliary valving mechanism in said hydraulic snubbing device directed to close said vent at various positions of said control piston to prevent motion of said control piston beyond such motion as needed.

30. A device as set forth in claim 29 above in which said incompressible fluid is coupled to a controllable pressure source capable of forcing said auxiliary piston and said control piston to move to a desired position.

31. A device as set forth in claim 30 above in which said controllable pressure source capable of forcing said auxiliary piston and said control piston to move to a desired position is regulated at a pressure that varies with speed of said internal combustion engine.

32. A device as set forth in claim 29 above in which said incompressible fluid is coupled to a sink of low pressure through a valve, said valve being controllable.

33. A device as set forth in claim 29 above in which said valving mechanism consists of said vent being placed in the wall of said control cylinder so positioned to interrupt flow of said liquid from said control cylinder when said control piston

covers said vent at the desired position of said control piston, said control cylinder being movable by a mechanism designed to position said control cylinder to control the snubbing of said auxiliary piston so as to place said vent such that flow of said liquid through said vent is substantially stopped by the outside diameter of said control piston when said control piston is in the position at which snubbing is desired.

34. A device as set forth in claim 29 above in which said valving mechanism includes a non-moving static piston substantially the same diameter as said auxiliary piston mounted coaxially with said auxiliary piston, said static piston placed within said control cylinder at the opposite end from said control piston, said control cylinder being open at both ends and slidably mounted to move coaxially with said static piston and said auxiliary piston.